THE GENUS MOUGEOTIA

EDGAR NELSON TRANSEAU
Department of Botany, Ohio State University

The species belonging to this genus are among the most widely distributed of all the freshwater algæ. In the vegetative condition they have been collected in arctic, temperate, and tropical regions of all of the continents and on the most isolated of the Pacific islands. They likewise occur in lakes, ponds, and temporary pools, and in all manner of springs, streams and rivers. In lakes they often form a part of the plankton either as isolated cells, or as short strait or coiled filaments. In permanent streams and ponds *Mougeotia* may be found throughout the year, while in temporary bodies of water they are among the first algæ to appear after a rainy period.

Certain species of *Mougeotia* exhibit a union of pairs of cells in adjoining filaments and a subsequent bending of the cells at the points of contact. This is known as "genuflexing" and was described by some of the earliest students of the filamentous algæ (Vaucher 1803, p. 79, Pl. 8). Some of these earlier students mistook genuflexing for conjugation, and Hassall limited the Genus Mougeotia to species that "reproduce" in this way.

Genuflexing is most frequently observed in *M. genuflexa* and its variety *gracilis*, but I have also observed it in *M. laetevirens*, *M. pulchella*, and *M. notabilis*. The phenomenon has been interpreted (1) as incipient conjugation, (2) as preparation for vegetative multiplication through the disintegration of the filaments and subsequent cell division, and (3) as a reaction for "interchange of soluble substances."

Genuflexing occurred every year in a certain pond in central Illinois from which I have frequent collections over a period of years. There it usually began early in April and continued until July or August. The mass of *Mougeotia* increased until late June or July and then decreased until there were only the usual scattered filaments the remainder of the summer. In the Autumn, vegetative *Mougeotia* became abundant, but there was no genuflexing. It is futile to assign physiological and ecological "functions" to this process since in the united knee-

joint cells, the chloroplasts usually contract and after a time the cells disintegrate and fall to the bottom. The continuation of vegetative growth comes mostly from those filaments that do not unite. Those who must have a function for genuflexing had best look upon it as a suicidal union due to unknown causes. Conjugation may occur when genuflexing is going on or at a different time. In another pond I have also observed genuflexing in which cells of two different species were united—one about half the size of the other. The species probably were *M. genuflexa* and *M. notabilis*, since both these species had been collected there previously in a fruiting condition.

In many shaded ponds in this latitude and in ponds of alpine and arctic regions vegetative growth apparently continues from year to year without change in form of the cells. Scattered akinetes (thick-walled vegetative cells) are formed. The four records from my Illinois collections falling in May, June, July and August.

Aplanospores are the only known reproductive structures in five of the species: *M. ventricosa*, *M. tropica*, *M. mayori*, *M. prona*, and *M. tenerrima*. Aplanospores are the usual mode of reproduction in *M. boodlei*. *M. calcarea* and *M. notabilis* are occasionally found producing only aplanospores, and aplanospores are usually present when these species are found fruiting sexually. Of the remaining thirty-seven species, aplanospores have been found in fourteen. We may say, therefore, that asexual reproduction by aplanospores is now known in twenty-two of the forty-five species described in this paper. G. S. West suggested that "there is in the early stages of aplanospore formation a more or less complete division of the protoplast into two parts which subsequently fuse together." This suggestion probably is based on the widely copied statement of Paul Petit that in *Spirogyra mirabilis* the aplanospores (which he regarded as zygospores) are formed in this way. I have examined hundreds of these aplanospores in all stages of development in several species of *Spirogyra*, *Mougeotia* and *Zygnema* and have never seen a cell in which the nucleus and cytoplasm divided and subsequently fused. Wittrock was quite right in his observation that in *M. ventricosa* the chromatophore *may* divide in the middle and the two halves pass into the swollen part of the sporogenous cell so that finally the nucleus lies between them. I have seen the same process in *M. boodlei*, *M. notabilis*, and *M. prona* (see Pl. VII, Fig. 111), but in none

of these did the cytoplasm or nucleus divide. In most instances the cytoplasm and the included structures merely aggregate toward the middle of the cell with loss of water and the subsequent formation of sporangium and spore walls. The initial cells of the aplanospores are usually about twice the length of the average vegetative cells, but there are numerous examples in which they are no longer than the vegetative cells.

In conjugation adjoining cells in different filaments develop protuberances which fuse and form a conjugating tube. In *M. genuflexa* and *M. scalaris* (in lateral conjugation) these protuberances may develop from adjoining cells of the same filament. Usually the protuberances are in contact from the beginning, but in many cases they are not in contact until later. I believe the same statement holds in scalariform conjugation but in that case it is impossible to prove except by direct observation.

As the conjugating tubes are being formed the chromatophores and most of the cytoplasm move into the tube, the median portions first. The tube then swells rapidly and may become several times the thickness of the filaments. The gametangia are then cut off by one, or two walls, depending upon whether or not the gametes pass completely into the conjugating tube. In the first instance the sporangium is "adjoined by two cells," i. e., the gametangia remain undivided; in the second case the sporangium is "adjoined by four cells," i. e., the middle part of each gametangium is occupied by a part of the sporangium. Subsequently a spore wall is secreted and this is usually yellow, brown, or blue, but in several species it is colorless. The spore wall may be smooth, punctate, scrobiculate, pitted or wrinkled.

Twin zygospores and combinations of zygospores and parthenospores are common in *M. capucina*. In these cases one or both gametes divide before the fusion of the gametangia (see Pl. X, Figs. 67 and 68).

The genus *Mougeotia* as here defined includes the species formerly described in the genera: *Gonatonema, Craterospermum, Mesocarpus, Plagiospermum, Staurospermum,* and *Pleurospermum.*

The writer has examined all the specimens of *Mougeotia* distributed in Wittrock and Nordstedt's Algæ aquæ dulcis exsiccatæ; Collin's, Holden, and Setchell's Phycotheca Boreali-Americana; Tilden's American Algæ; those in the U. S. National Herbarium, and other specimens sent him by the late Professor

Nordstedt, Professor Borge, (Stockholm), the late Professor Farlow, Dr. Cedercreutz, (Helsingfors), Dr. M. Higashi, (Tokio), Dr. D. B. Anderson, Dr. L. H. Tiffany, Dr. G. E. Nichols, Dr. W. M. Barrows and Dr. F. C. Baker. His own collections include specimens from most of the states east of the Mississippi River.

MOUGEOTIA (Agardh, 1824) Wittrock, 1872.

Key to the Species.

1. With aplanospores (zygospores rare or unknown)..... 33
1. With zygospores (rarely aplanospores also)..... 2
2. Sporangium between 2 undivided gametangia (adjoined by 2 cells).. 3
2. Sporangium dividing one of the gametangia (adjoined by 3 cells).. 21
2. Sporangium dividing both gametangia (adjoined by 4 cells)..... 22
3. Sporangium globose, subglobose, ovoid or ellipsoid..... 4
3. Sporangium cylindric with concave sides..... 18
3. Sporangium compressed spherical, compressed ovoid, or compressed ellipsoid..... 19
4. Spore wall smooth..... 5
4. Spore wall punctate, diam. veg. cells 11–14μ..... 16. *M. ovalis*
4. Spore wall scrobiculate, pitted or wrinkled..... 16
5. Diam. veg. cells usually less than 12μ..... 6
5. Diam. veg. cells usually more than 12μ, less than 24μ..... 9
5. Diam. veg. cells usually more than 24μ, less than 40μ..... 13
5. Diam. veg. cells more than 40μ..... 15
6. Spores globose..... 7
6. Spores more or less ellipsoid, longer axis, 20–28μ.. 2b. *M. parvula ellipsoideis*
6. Spores variable, some extending into the gametangia..... 1. *M. calcarea*
7. Outer sporangium wall a thick transparent pectic layer..... 20. *M. victoriensis*
7. Sporangium without outer pectic layer..... 8
8. Diameter spores 7–8μ..... 2a. *M. parvula angusta*
8. Diameter spores 13–24μ..... 2. *M. parvula*
9. Spores variable, some extending into gametangia..... 1. *M. calcarea*
9. Spores globose..... 10
9. Spores ovoid to quadrate ovoid..... 12
10. Sporangium wall with pectic layer, spores blue..... 19. *M. maltae*
10. Sporangium wall without pectic layer, spores brown..... 11
11. Diameter spores 23–33μ..... 3. *M. recurva*
11. Diameter spores 30–40μ..... 5. *M. scalaris*
12. Diameter spores 24–30μ, conj. lateral..... 14a. *M. genuflexa gracilis*
12. Diameter spores 40–45μ, cong. scalariform..... 10. *M. sphaerocarpa*
13. Spores more than 50μ in diameter..... 13. *M. macrospora*
13. Spores 30–40μ in diameter..... 14
14. Cong. scalariform, spores usually globose..... 5. *M. scalaris*
14. Cong. usually lateral, spores quadrately globose..... 14. *M. genuflexa*
15. Spores about 40μ in diameter..... 11. *M. subcrassa*
15. Spores 60μ or more in diameter..... 12. *M. crassa*
16. Diameter vegetative cells 8–16μ, sp. diam. less than 40μ..... 4. *M. nummuloides*
16. Diameter veg. cells 17–20μ, sp. diam. more than 40μ..... 6. *M. megaspora*
16. Diameter veg. cells 22μ or more..... 17
17. Spores globose, wall wrinkled, diameter 30μ..... 7. *M. gotlandica*
17. Spores ovoid, wall punctate, 30μ x 40μ..... 8. *M. pulchella*
17. Spore ovoid, wall scrobiculate, 38μ x 50μ..... 9. *M. robusta*

18. Spores 20μ in diameter ..... 21. *M. angolensis*
18. Spores 36–50μ in diameter ..... 22. *M. laetevirens*
19. Spores with thick outer transparent pectic layer 20
19. Spores without a thick outer layer, diameter veg. cells 7–12μ ..... 15. *M. depressa*
20. Spores brown, diameter veg. cells 13–18μ ..... 17. *M. gelatinosa*
20. Spores blue, wall punctate, diameter veg. cells 14–20μ ..... 18. *M. cyanea*
21. Spores variable, globose to ovoid or quadrate, diameter 30–40μ ..... 1. *M. calcarea*
21. Spores globose not filling the 3-lobed sporang., diameter 16–20μ ..... 23. *M. notabilis*
21. Spores cylindric, 48–56μ x 64–78μ ..... 22a. *M. laetevirens varians*
22. Spore wall smooth 23
22. Spore wall punctate, scrobiculate, or verrucose 28
23. Diameter veg. cells more than 12μ 24
23. Diameter veg. cells less than 10μ 25
24. Spores brownish violet with angles produced ..... 37. *M. capucina*
24. Spores quadrate regular, with sides 22–28μ long .. 26. *M. fragilis*
25. Angles of zygospores rounded or undulate truncate 26
25. Angles of zygospores retuse; margins concave ..... 25. *M. viridis*
25. Angles of zygospores produced 27
26. Diameter veg. cells 3.5–4.5μ ..... 24. *M. elegantula*
26. Diameter veg. cells 8–9μ ..... 27. *M. virescens*
26. Diameter veg. cells 11.5–13.5μ ..... 28. *M. paludosa*
27. Diameter veg. cells 4–5μ, zyg. irreg., processes truncate ..... 31. *M. americana*
27. Diameter veg. cells 5–6μ, zyg. rounded, processes short rounded ..... 34. *M. corniculata*
27. Diameter veg. cells 6–8μ, zyg. wall very thick, processes long rounded ..... 35. *M. uberosperma*
28. Spore wall punctate 29
28. Spore with concave sides, wall verrucose ..... 33. *M. gracillima*
28. Spore with convex sides, wall minutely scrobiculate ..... 39. *M. tumidula*
29. Diameter veg. cells 13μ or less 30
29. Diameter veg. cells more than 13μ 32
30. Zygospores quadrate 31
30. Zygospores cruciate quadrate, diameter veg. cells 8–10μ ..... 40. *M. punctata*
30. Zygospores quadrate with angles produced ..... 42. *M. producta*
31. Diameter veg. cells 4–5μ, reproduction mostly by aplanospores ..... 29. *M. boodlei*
31. Diameter veg. cells 8–13μ, sides of zygospores 28–40μ ..... 32. *M. quadrangulata*
32. Zygospores ovoid-globose 38–46μ x 38–48μ ..... 43. *M. aspera*
32. Zygospores irregular quadrate, with long processes ..... 38. *M. irregularis*
33. Diameter veg. cells 4–5μ, spores oblique ellipsoid 35
33. Diameter veg. cells 6–7μ, spores oblique globose ... 36. *M. tropica*
33. Diameter veg. cells 8–13μ 34
33. Diameter veg. cells 13–15μ, spores oblique ellipsoid, punctate ..... 45. *M. mayori*
34. Aplanospores globose to ovoid smooth, diam. 17–21μ ..... 1. *M. calcarea*
34. Aplanospores ellipsoid with retuse ends, punctate ..... 41. *M. prona*
34. Aplanospores ovoid to ellipsoid, 12–24μ x 16–29μ, smooth ..... 44. *M. ventricosa*
35. Spore wall smooth ..... 30. *M. tenerrima*
35. Spore wall punctate ..... 29. *M. boodlei*

1. *M. calcarea* (Cleve) Wittrock, 1872.

Bih. till K. Sv. Vet. Akad. Handl. I, No. 1; *Sphaerospermum calcareum* Cleve, 1868; *Mougeotia sphaerica* Gay, Essai d'une Monographie locale des Conjuguees. Montpellier, 1884; *Gonatonema sphaerospora* Borge, Arkiv. for Botanik, 1:282. 1903.

Vegetative cells 8–14μ x 40–280μ, chromatophore .5–.7 the cell length, cells elongating and becoming geniculate before spore formation; zygospores globose, 25–30μ in diameter or angular-globose, 22–28μ x 30–50μ, wholly in the tube, or extending into one or both gametangia, spore wall smooth, colorless; aplanospores globose, lateral to the sporogenous cell or extending into the sporogenous cell, 17–21μ in diameter, or rarely trapezoid ovoid dividing the sporogenous cell, 15–20μ x 20–28μ.

United States: Illinois, Michigan, Mississippi, Ohio. Sweden, France, Greenland, North Africa, Brazil, British Columbia.

(Plate I, Figs. 9–14).

This is the most variable of all the described species and shows all of the types of spore formation which led the early students of the group to postulate several distinct genera. In Mississippi, Illinois and Brazil only the aplanospores have been found.

a-var. *bicalyptrata* (Wiitrock) *comb. nov.*

W. & N. Alg. Exsic. No. 741; Bot. Not. 1886, p. 135.

Vegetative cells 10–12μ x 30–110μ; zygospores with thickened end walls adjoining the gametangia, sometimes completely closing the gametangia.

United States: Michigan. British Columbia, Sweden.

(Plate I, Fig. 8).

2. *M. parvula* Hassall, 1843.

Ann. and Mag. Nat. Hist. 11:434.

Vegetative cells 6–12μ x 30–140μ chromatophore usually occupying two-thirds of the cell with 4–6 pyrenoids, sporangia adjoined by two cells; zygospores formed wholly in the conjugating tube, globose, 13–24μ in diameter, wall thick, smooth, brown; aplanospores obliquely ovoid, 16–20μ x 20–24μ.

United States: Massachusetts, Rhode Island, Michigan, Ohio, North Carolina. British Isles, Germany, Austria, Switzerland, France, Sweden, Norway, Belgium, Finland, Czecho-Slovakia, Brazil, Japan.

(Plate I, Figs. 1–3).

a-var. *angusta* (Hass.) Kirchner 1878.

Alg. Schless, p. 128. *Mesocarpus angustus* Hass. 1845; *Sphaerocarpus angustus* Hass., 1843a.

Vegetative cells 5–6μ x 30–95μ, zygospore diameter 7–8μ.

United States: South Carolina. British Isles, Germany, Austria, Belgium, Czecho-Slovakia.

b-var. *ellipsoideis* W. & G. S. West, 1907.
Ann. Roy. Bot. Gard., Calcutta, 6, part 2.

Vegetative cells as in the type, zygospores ellipsoid.
Burma.
(Plate I, Figs. 4–5).

3. *M. recurva* (Hass.) De Toni, 1889.
Sylloge Algarum, p. 714. *Mesocarpus recurvus* Hassall, 1845; *Sphaerocarpus recurvus* Hassall, 1843a.

Vegetative cells 12–18μ x 50–180μ, sporangia adjoined by 2 cells; zygospores globose, 23–33μ; median spore wall smooth, brown; aplanospores globose (diam. 24μ) at the angles of geniculate cells, or cylindric ovoid 14μ x 34μ in straight cells.

United States: Douglas Lake, Michigan. British Isles, Germany, Australia, South America.
(Plate I, Figs. 6–7).

4. *M. nummuloides* (Hassall) De Toni, 1889.
Sylloge Alg., p. 713, P. B. A. 714.

Vegetative cells 8–16μ x 32–160μ, sporangia adjoined by 2 cells; zygospores globose to ovoid 17–37μ in diameter; aplanospores ovoid within the angled sporogenous cell; median spore wall brown, scrobiculate.

United States: Maine, Massachusetts, New Jersey, North Carolina, Ohio. British Isles, Belgium, Luxemburg, Germany, Sweden, Czecho-Slovakia, Finland.
(Plate I, Figs. 15–16).

5. *M. scalaris* Hassall, 1842.
Ann. and Mag. Nat. Hist., 10:34.

Vegetative cells 20–34μ x 40–180μ; fertile cells straight or slightly curved; sporangia adjoined by 2 cells; zygospores ovoid to globose 30–38μ–(40μ) in diameter; median wall smooth, yellow-brown, occupying the conjugating tube.

United States: South Carolina, Georgia, Illinois, New Jersey, Pennsylvania, Florida, Iowa, Ohio. Great Britain, Sweden, Belgium, France, Russia, Italy, Germany, Czecho-Slovakia, Queensland, New Caledonia, Japan, Luxemburg.
(Plate II, Figs. 25–27).

a-var. *macrospora* Hirn. 1895.
Acta Soc. pro Fauna et Flora Fennica 11, No. 10.

Vegetative cells 25–28μ x 60–140μ; zygospores ovoid larger than the type, 40–48μ x 43–50μ.

United States: Michigan. Finland.

6. *M. megaspora* Wittrock, 1872.
Bih. till K. Sv. Vet. Acad. Handl. 1, No. I.

Vegetative cells 17–19.5μ x 170–380μ, sporangia adjoined by 2 cells; zygospore globose to ovoid, 41–44μ x 45.5–48μ; median spore wall brown, irregularly scrobiculate.
Sweden.
(Plate II, Fig. 23).

7. *M. gotlandica* (Cleve) Wittrock, 1872.
Bih. till K. Sv. Vet. Akad. Handl. 1, No. 1.

Vegetative cells about 22μ x 75–150μ; sporangium adjoined by 2 cells; zygospores globose, about 30μ in diameter; median spore wall yellow-brown, wrinkled.
Sweden, Luxemburg.
(Plate II, Fig. 24).

8. *M. pulchella* Wittrock, 1871.
Hedwigia, p. 88.

Vegetative cells 24–29μ x 48–150μ; sporangium adjoined by 2 cells; zygospores ovoid to ellipsoid with ends more or less flattened, 28–35μ x 40–50μ; median spore wall yellow-brown, punctate.
United States: Douglas Lake, Michigan. Sweden, Germany.
(Plate IV, Fig. 53).

9. *M. robusta* (De Bary) Wittrock, 1885.
W. & N. Alg. Exsicc., No. 651.

Vegetative cells 25–33μ x 75–260μ, chromatophores with many irregularly distributed pyrenoids, zygospores adjoined by 2 cells, ovoid to subglobose, 35–41μ x 47–54μ, wall scrobiculate, brown.
United States: Iowa, Ohio, Massachusetts, New Jersey, Illinois. Germany, Japan.
(Plate III, Figs. 39–41).

A rather common species in the eastern United States. Both the species and variety have occasional filaments with two parallel chromatophores in each cell, or a single chromatophore more or less divided toward the ends. Distinguished from *M. gotlandica* (Cleve) Wittr. by its larger dimensions, and the color and marking of the spore wall; from *M. pulchella* Wittr. by the reddish brown color of the spores.

a-var. *biornata* Wittrock, 1884.
W. & N. Alg. Exsicc., No. 615; Bot. No. t 1884, p. 126.

Vegetative cells 22–30μ x 25–240μ; zygospores 30–38μ x 42–50μ, outer wall inwardly verrucose, fitting the scrobiculations of the median wall.
United States: Illinois, Iowa, Ohio, Michigan. Sweden, Ceylon.

The structure of the outer wall may be readily demonstrated by crushing a spore and adding a drop of potassium hydroxide or some other reagent that will cause the wall to swell.

10. *M. sphaerocarpa* Wolle, 1887.
Freshwater algæ, p. 227; *M. minnesotensis* Wolle, 1887; *M. divaricata* Wolle, 1887.

Vegetative cells 19–24μ x 60–120μ (–240μ), gametangia curved, usually 4–6 pyrenoids; zygospore in the greatly enlarged conjugating tube, or extending into the gametangia, ovoid to subglobose, 40–45μ in diameter or ovoid 36–40μ x 40–55μ, wall smooth, brown; aplanospores ovoid to obliquely ovoid 24–30μ x 35–50μ.

United States: Minnesota, New Jersey, Pennsylvania, Illinois, Iowa, Ohio, California, Florida.

(Plate III, Figs. 28–33).

var. *varians* var. nov.

Vegetative cells 24–28μ x 100–240μ, aplanospores ovoid 34–36μ x 38–42μ, zygospores frequently ovoid 35–44μ x 44–60μ, touching one or both of the outer walls of the gametangia.

Manila, Philippine Islands. (Collected by Walter R. Shaw).

(Plate III, Figs. 34–35).

This new variety superficially resembles *Debarya africana* G. S. West, but differs in the thickening of the end walls of the gametangia and in the fact that only a part of the contents of the conjugating cells enter the zygospore.

11. *M. subcrassa* G. S. West, 1906.
Jour. Linn. Soc. Bot., 39:50.

Vegetative cells 41.5–43μ x 240–280μ, chromatophore with 15–24 pyrenoids deposited irregularly; conjugating cells straight or slightly curved; zygospores globose between two undivided gametangia, 40–41μ in diameter, outer wall smooth and indistinctly lamellate. Sporangial wall thicker at the ends of the tube.

Victoria, Australia.

(Plate IV, Fig. 54).

12. *M. crassa* (Wolle) De Toni, 1889.
Sylloge algarum, p. 716; *Mesocarpus crassus* Wolle, Bull.Torrey Bot. Club, 12:127, 1885.

Vegetative cells about 50μ x 200–500μ spores globose, about 65μ in diameter, filling the tube, not extending into the gametangia, outer wall smooth.

United States: Florida.

(Plate III, Fig. 38).

The large size of the vegetative cells distinguishes this from all other described species. I have found vegetative filaments of these dimensions in Illinois, Mississippi and Alabama, but the fruiting record is based on Wolle's collection and description.

13. *M. macrospora* (Wolle) De Toni, 1889.
Sylloge Algarum, p. 716; *Mesocarpus macrosporus* Wolle, 1887.

Vegetative cells about 30μ x 180–300μ; gametangia slightly recurved; sporangia adjoined by 2 cells; zygospores globose, 55–60μ in diameter, outer wall smooth, fully occupying the greatly enlarged tube.
United States: Pennsylvania, New Hampshire.
(Plate III, Fig. 36).

Distinguished from *M. sphaerocarpa* Wolle and *M. crassa* (Wolle) De Toni, which it resembles, by the differences in dimensions of both vegetative cells and spores. The species seems not to have been found since Wolle's records and his specimens are lost.

14. *M. genuflexa* (Dillwyn) Agardh., 1824.
Systema Alg., p. 83; *Mesocarpus pleurocarpus* DeBary, *Mougeotia mirabilis* (A. Br.) Wittr.

Vegetative cells 25–38μ x 50–225μ, often geniculate and attached to other similar cells forming extensive nets, sometimes with rhizoidal branches; conjugation lateral, less frequently scalariform; sporangia adjoined by 2 cells; zygospores quadrately ovoid to globose, 30–40μ in diameter; wall smooth, brown.
United States: Maine, Massachusetts, Connecticut, New Jersey, Pennsylvania, Michigan, Minnesota, Illinois, Iowa, Ohio, Louisiana. British Isles, Sweden, Denmark, Belgium, Luxemburg, Germany, Russia, Austria, France, Czecho-Slovakia.
(Plate IV, Figs. 43–44).

a-var. *gracilis* Reinsch, 1867.
Die Alg. Flora von Franken, p. 215. P. B. A. 312.

Vegetative cells 15–24μ in diameter; zygospores 24–30μ in diameter; otherwise like the type.
United States: Illinois. Germany, Czecho-Slovakia, Java.
(Plate IV, Fig. 45).

15. *M. depressa* (Hassall) Wittrock, 1880.
Skandinaviens vaxter, part 4; *Mesocarpus depressus* Hass., 1845; *Sphaerocarpus depressus* Hass., 1843a.

Vegetative cells 7–12μ x 35–144μ; sporangia adjoined by 2 cells; conjugation lateral and scalariform; zygospores compressed ellipsoid 12–14μ x 28–32μ, longer axis parallel to the filaments, median wall punctate, brown.
United States: Gainesville, Florida. British Isles, Germany, Sweden, Luxemburg.
(Plate II, Fig. 20).

Evidently closely related to *M. parvula* Hass., from which it differs in the form of the spore and spore wall.

16. *M. ovalis* (Hassall) Nordstedt, 1886.
W. & N. Alg. Exsicc., No. 742; Botaniska Nortiser, 1886, p. 136.

Vegetative cells 11–14μ x 110–140μ; sporangia adjoined by two cells; zygospore compressed ovoid to subglobose 26–36μ x 29–38μ; median spore wall pitted.
British Isles, Italy, Germany.
(Plate III, Fig. 37).

17. *M. gelatinosa* Wittrock, 1889.
W. & N. Alg. Exsicc. No. 957, fasc. 21, pp. 26-27.

Vegetative cells 13–18μ x 120–180μ; sporangium adjoined by 2 cells; zygospores compressed ovoid, 38–47μ x 28–39μ, not including the outer pectic layer, which may be 7–10μ in thickness; median spore wall brown, smooth.
British Isles, Sweden, Finland.
(Plate II, Fig. 17).

In this and the three following species the pectic layer is quite transparent and is visible largely through the accumulation of clay particles on its exterior surface. At maturity the pectic layer may be absent from some of the spores, apparently having gone into solution.

18. *M. cyanea* sp. nov.

Vegetative cells (14–) 16–18μ (–20μ) x 160–200μ, chromatophore occupying one-third to one-half of the cell, with 4 to 10 pyrenoids in a straight line; zygospores compressed spherical 30–40μ x 38–48μ with the longer axis parallel to the filaments; aplanospores spheroidal, laterally placed in the sporogenous cell, 30–32μ in diameter; both kinds of spores surrounded at maturity with a transparent pectic layer 4μ to 8μ thick; spore wall finely punctate, blue.
United States: Douglas Lake, Michigan. (Collected by G. E. Nichols).
(Plate II, Figs. 21–22).

19. *M. maltae* Skuja, 1926.
Acta Horti Botanici, Univ. Latviensis, 1:109. Fig. 1 and Pl. I, Fig. 1.

Vegetative cells 17–22μ x 60–120 (–200)μ; chromatophore nearly as long as the cell with 4 to 8 pyrenoids; conjugating cells slightly incurved; zygospores globose (30)–32–35–(40)μ in diameter, spore wall smooth, blue, surrounded by a gelatinous layer 4 to 6μ in diameter.
Usma Lake, Latvia.
(Plate II, Fig. 18).

20. *M. victoriensis* G. S. West, 1909.
Jour. Linn. Soc. Bot., 39:51.

Vegetative cells 11–12μ x 100–160μ; chromatophores with two to seven, usually 5 or 6, pyrenoids arranged in a single slightly irregular

series; conjugating cells recurved; zygospores globose contained within the tube; median spore wall smooth; surrounding the sporangium a layer of pectic material develops which extends even beyond the outer sides of the gametangia. Diameter of the spores 21–24μ; diameter including the pectic coat, 60–63μ.

Victoria, Australia.

(Plate II, Fig. 19).

21. *M. angolensis* W & G. S. West, 1897.

African Freshwater Algæ, Jour. Bot. 35:39.

Vegetative cells 25–29μ x 100–145μ, chromatophores with 4 to 6 very small pyrenoids irregularly disposed; zygospores short cylindric with concave sides, 19–21μ in diameter; wall smooth; gametangia slightly curved.

Angola, Africa.

(Plate IV, Fig. 42).

The chromatophore has fewer pyrenoids and the zygotes are smaller than in *M. laetevirens* (A. Br.) Wittr.

22. *M. laetevirens* (Braun) Wittrock, 1877.

W. & N. Alg. Exsicc., No. 58; Bot. Notiser, 1877, p. 23.

Vegetative cells 22–40μ x 65–350μ, many pyrenoids irregularly disposed conjugating cells geniculate; sporangia adjoined by 2 cells; zygospores contained in the tube, outer wall short cylindric, 36–47μ x 45–72μ with concave sides; aplanospores ovoid or obliquely ovoid; median wall smooth, yellow-brown.

United States: Ohio, New Jersey, Long Island, N. Y., Michigan, New Hampshire, Massachusetts, Wisconsin, North Carolina. Sweden, Germany, Luxemburg, Czecho-Slovakia, Finland, Queensland, Paraguay, Outer Mongolia, Brazil.

(Plate IV, Figs. 46–50).

a.-var. *varians* Wittrock, 1886.

W. & N. Alg. Exsicc., No. 740; Bot. Notiser, 1886, p. 135.

Zygospores extending into or across the gametangia, sporangia adjoined by 2, 3, or 4 cells; spores 48–56μ x 64–78μ.

Sweden, Germany, Czecho-Slovakia.

(Plate IV, Figs. 51–52).

23. *M. notabilis* Hassall, 1840.

Ann. and Mag. Nat. Hist., 10:46; *Plagiospermum tenue* Cleve, 1868; *Mougeotia tenuis* (Cleve) Wittrock, 1872; *Mougeotia Transeaui* Collins, 1912.

Vegetative cells 10–18μ x 50–250μ, usually only one gametangium is divided by the sporangium which is consequently triangular ovoid; zygospores not completely filling the sporangia, more or less ovoid to subglobose, 24–28μ x 26–36μ; aplanospores obliquely ovoid to trapezoid 16–20μ x 25–30μ, sporogenous cell geniculate or straight; spore wall smooth.

United States: Illinois, Iowa, Ohio, Pennsylvania, New Jersey, Florida. Sweden, British Isles.

(Plate V, Figs. 55–59).

There is no doubt about the identity of the species figured by Hassall. It contained only aplanospores and is quite similar to immature aplanosporic material found in Illinois. Collins' species was described from the first material of the kind which I found in Illinois. Subsequently an abundance of material was found which established the identity of the three species. I have seen material upon which Wolle based his *Mougeotia tenuis* var. crassa, and it is typical of *M. notabilis*.

24. *M. elegantula* Wittrock, 1872.
Om Gotlands, etc., p. 40.

Vegetative cells 3.5–4.5μ x 50–135μ; chromatophores with 4–8 pyrenoids; conjugating cells geniculate, sporangium adjoined by 4 cells; zygospores cruciate-quadrate, 18–24μ with smooth, hyaline walls, the corners rounded.

United States: Massachusetts, Illinois, Michigan. Sweden, West Indies.

(Plate VI, Figs. 84–87).

25. *M. viridis* (Kuetz.) Wittrock, 1872.
Om Gotlands, etc., p. 39.

Vegetative cells 6–8μ x 24–80μ; chromatophores occupying most of the cell with 4–6 pyrenoids; zygospores adjoined by 4 cells, quadrate with concave sides, and retuse angles, 22–32μ on the side; aplanospores oblique ellipsoid, 14–16μ x 30–36μ; median spore wall smooth, colorless.

United States: New Jersey, Wisconsin, Illinois, Florida. British Isles, Sweden, Germany, Czecho-Slovakia, Austria, Hungary, France, Belgium, Russia, Finland, Luxemburg.

(Plate VII, Figs. 97–98).

26. *M. fragilis* (Zeller) De Toni, 1873.
Hedwigia, p. 174.

Vegetative cells 17–22μ x 85–200μ, zygospores quadrangular with sides 22–28μ long. Spore wall smooth.

Pegu, Burma.

27. *M. virescens* (Hassall) Borge, 1923.
Zygnemales in Pascher's Susswasserflora, 9:43; *Staurocarpus virescens* Hassall, 1845.

Vegetative cells 8–9μ x 30–110μ, sporangia adjoined by 4 cells; zygospores quadrate, with concave sides, 29–34.5μ; wall colorless, smooth, with rounded corners.

British Isles.

(Plate VII, Fig. 104).

27. *M. paludosa* G. S. West, 1899.
Algalflora of Cambridgeshire. Jour. Bot. 37:108, pl. 395, figs. 4–6.

Vegetative cells 11.5–13.5μ x 70–185μ, chromatophores short, occupying about one-third the length of the cell with about 5 pyrenoids; fertile cells recurved; zygospores ovoid to quadrangular ovoid, adjoined by 4 cells; angles undulate truncate; outer wall of zygospore thick, colorless; spores 32–38μ x 44–49μ.
Cambridgeshire, England.
(Plate V, Figs. 73–75).

Distinguished from all other species by the thick colorless spore wall with its undulate truncate angles. Probably nearest *M. capucina* (Bory) Agardh from which it is readily distinguished by its smaller dimensions and absence of the violet color.

29. *M. Boodlei* (W. & G. S. West) Collins, 1912.
Tufts College Studies, 3:69.

Vegetative cells 4–5μ x 25–225μ; chromatophore .5–8 the length of the cell, with 4–6 pyrenoids; zygospores quadrate, 15–18μ x 15–23μ; corners somewhat rounded; aplanospores ellipsoid, 12–15μ x 23–25μ, projecting slightly on the convex side of the slightly curved sporangia; spore wall punctate, yellow-brown.
United States: Illinois. British Isles.
(Plate VI, Figs. 78–80).

30. *M. tenerrima* G. S. West, 1914.
Mem. Soc. neuchateloise Sci. Nat. 5:1028.

Vegetative cells 4.5μ x 110–135μ, chromatophores with 6 pyrenoids in one series; zygospores unknown; aplanospores oblique-ellipsoid, 12–13μ x 24–25μ, ends slightly mamillate, wall smooth.
South America: Columbia.
(Plate VI, Figs. 81–83).

31. *M. americana* Transeau, 1918.
Tech. Pub. No. 9, N. Y. State Coll. of Forestry, p. 237.

Vegetative cells 4–5μ x 40–120μ; conjugating cells slightly or strongly geniculate; zygospore adjoined by four walls, irregularly quadrate with concave or convex sides; angles produced and truncate, the space between the zygospore and the sporangium walls being filled with pectic material, 13–24μ x 18–32μ, wall smooth, transparent; aplanospores obliquely elliptical, ends truncate at the middle of very long genuflexed vegetative cells, 10–14μ x 20–26μ.
Oneida Lake, N. Y.; Douglas Lake, Mich.
(Plate VI, Figs. 88–93).

32. *M. quadrangulata* Hassall 1843.
Ann. and Mag. of Nat. Hist. 11:434. DeBary, 1858, Sranrospermum quadration.

Vegetative cells 8–13μ x 50–140μ; with 8 to 16 pyrenoids in a line, conjugating cells geniculate, sporangia adjoined by 4 cells; zygospores

quadrate with straight sides and truncate corners or rarely with angles retuse, 28–40μ on a side, with colorless, punctate wall; aplanospores obliquely ovoid, 20–21μ x 36–44μ.

United States: Illinois, Ohio, Michigan, Massachusetts, New Jersey, North Carolina, Florida. British Isles, Belgium, Germany, Russia, France, Czecho-Slovakia, Sweden, Austria, Poland.

(Plate V, Figs. 70–72).

33. *M. gracillima* (Hassall) Wittrock, 1872.
Om. Gotlands, etc., p. 40.

Vegetative cells 5–7μ x 55–140μ; sporangia adjoined by 4 cells (rarely 3); zygospore quadrate, with deeply concave sides, 20–25μ x 20–28μ, angles retuse; wall minutely verrucose.

United States: Illinois, New York, Massachusetts, Michigan. British Isles, Sweden, Luxemburg, Germany, Czecho-Slovakia, France.

(Plate VI, Figs. 95–96).

34. *M. corniculata* Hansgirg, 1886.
Oesterr. Botan. Zeitschr., No. 10.

Vegetative cells 5–6μ x 30–180μ; sporangia adjoined by 4 cells; zygospores quadrately ovoid, 22–26μ x 22–26μ; median spore wall yellow-brown, smooth, thickened, forming rounded processes at the corners.

Czecho-Slovakia.

(Plate VI, Fig. 94).

35. *M. uberosperma* W. & G. S. West, 1897.
Welwitsch's African Freshwater Algæ. Jour. Bot. 35:37.

Vegetative cells 6–8μ x 24–64μ, fertile cells recurved; zygo sporangia dividing both gametangia; zygospores angular globose (4–6 angles), wall very thick and lamellate, colorless, with corners extended into 4 solid unequal processes which project into the gametangia; diameter of the zygospores 21–27μ; processes 3–18μ long. Aplanospore 20μ x 30μ with two processes.

Angola and Kentani, Africa.

(Plate VII, Figs. 102–103).

36. *M. tropica* (W. & G. S. West, 1916.
Algæ, p. 337; Annals of Botany 12:39, Pl. 4; *Gonatonema tropicum*, Jour. Bot. 35:38, 1897.

Vegetative cells 6–7μ x 36–56μ with two pyrenoids in the chromatophore; zygospores unknown; aplanospores obliquely globose with projecting mamillate solid processes, median wall yellow-brown, scrobiculate, 27–28μ x 27–29μ, with the processes 42–46μ in length.

Angola, Africa.

(Plate VII, Fig. 112).

37. *M. capucina* (Bory) Agardh., 1824.
Systema algarum, p. 84; *Staurospermum capucinum* De Bary, 1858, p. 81.

Vegetative filaments usually violet colored, cells 14–21μ x 70–280μ (–340μ); chromatophore with 4–6 (–8) pyrenoids, frequently rod-shaped, occupying one-third to one-fourth the length of the cell, or ribbon-like containing 12–16 chromatophores in a line and extending three-fourths the length of the cell; sporangium walls formed at a distance (5–52μ) from the zygospore, the intervening space being filled with pecto-cellulose compounds; sporangium dividing both gametangia; zygospores irregularly quadrangular with concave sides 50–70μ x 60–100μ, wall violet-brown, thick especially at the angles, smooth; aplanospores not uncommon 20–36μ x 45–70μ (–80μ) with more or less thickened ends.

United States: Long Island, N. Y.; North Carolina, Florida, Alabama. British Isles, France, Sweden, Belgium, Switzerland, Italy, Brazil, New Zealand.

(Plate V, Figs. 62–69).

38. *M. irregularis* W. & G. S. West, 1897.
Welwitsch's African Freshwater Algæ. Jour. Bot. 35:38.

Vegetative cells 13.5–15μ x 70–90μ; conjugating cells more or less recurved; sporangium dividing both gametangia; zygospores irregularly quadrate or trapezoid with concave sides and thick walls; angles with horn-like processes of varying length with rounded ends; median spore wall thick, yellow to yellow brown, punctate; extreme length of zygospore including the processes 38–63μ, extreme width, 42–48μ.

Angola, Africa.

(Plate V, Figs. 60–61).

39. *M. tumidula* Transeau, 1914.
Amer. Jour. Bot. 1:297.

Vegetative cells 6–8.5μ x 70–120μ, chromatophore with 4 to 8 pyrenoids, sporangia adjoined by 4 cells; zygospores quadrate, somewhat tumid 22–26μ x 26–30μ, angles retuse, walls colorless, minutely but distinctly scrobiculate; aplanospores obliquely ellipsoid 12–14μ x 28–32μ, with retuse ends and scrobiculate wall.

United States: Illinois, Iowa.

(Plate VII, Fig. 105).

40. *M. punctata* Wittrock, 1867.
Algolgiska studier, I. Upsala.

Vegetative cells 8–10μ x 50–120μ; sporangia adjoined by four cells; zygospores quadrate, 30–38μ on a side, 18–20μ thick; sides concave with obtuse angles, outer wall crenulate, inner nearly smooth.

Upland, Sweden.

(Plate VII, Figs. 99–101).

41. *M. prona* sp. nov.

Vegetative cells 8–12μ x 60–140μ (–280μ) with 6 to 12 pyrenoids; aplanospores 20–24μ x 40–52μ (–60μ), sporangium obliquely ellipsoid

with ends produced and truncate, spore wall faintly yellow and finely punctate with retuse ends.

United States: Long Island, N. Y.

(Plate VII, Figs. 109–111).

This species occurred abundantly in 1924 in a rivulet below a roadside spring on the south side of High Hill. It produced aplanospores throughout July and early August. Distinguished from *M. tumidula* Transeau by its larger size and yellowish walls; from *M. quadrangulata* (Hass) Wittr. by the retuse angles and yellowish walls. Evidently near *M. punctata* Wittr., but no zygospores, which might have connected it with that species were found.

42. *M. producta* G. S. West, 1907.

Freshwater Algæ from Burma. Annals Royal Bot. Gard., Calcutta 6,part 2.

Vegetative cells 7–8μ x 84–160μ; zygosporangia adjoined by 4 cells; zygospores quadrate, with concave or slightly convex sides, angles produced and truncate, 29–37μ on a side; aplanospores obliquely ellipsoid with ends produced and with a similar thickening near the ends, 14–18μ x 30–40μ; median spore wall punctate, colorless.

Burma.

(Plate VII, Figs. 113–114).

43. *M. aspera* Voronikhin.

Notulæ syst. ex Inst. Crypt. Horti bot. Petropolitani, 2:192. Petrograd, 1923.

Vegetative cells 13–16.5μ x 78–112μ; sporangium adjoined by 4 cells; zygospores globose, 36–46μ in diameter, rarely ovoid 46μ x 66μ; median spore wall pale brown, punctate.

Tiflis, Georgia (Asia Minor).

44. *M. ventricosa* (Wittrock) Collins, 1912.

Tufts College Studies, 3:69.

Vegetative cells 5–9μ x 100–140μ; zygospores unknown; aplanospores obliquely ellipsoid to subglobose, 12–24μ x 16–29μ; median spore wall smooth, yellow-brown.

United States: Pennsylvania, California, Michigan. Europe.

(Plate VII, Figs. 106–108).

45. *M. mayori* G. S. West, 1914.

Mem. Soc. Neuchateloise d. Sci. Nat. 5, 1027.

Vegetative cells 13–15μ x 235–315μ with 11 to 14 pyrenoids; aplanospores 24–26μ x 34–38μ, obliquely ellipsoid with truncate ends, median spore wall yellow, punctate.

Central Andes of Columbia, South America.

(Plate V, Figs. 76–77).

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EXPLANATION OF PLATES.

PLATE I.

Figs. 1–2. *Mougeotia parvula*—Finland, Nylandia. Coll. C. Cedercreutz. June 21, 1921.

Fig. 3. *M. parvula*—Aplanospore from Burgaw, North Carolina. Coll. D. B. Anderson, March 30, 1926.

Figs. 4–5. *M. parvula* var. *ellipsoideis*—After W. & G. West, 1907. Burma.

Figs. 6–7. *M. recurva*—Douglas Lake region, Michigan. Coll. G. E. Nichols. August 10, 1925.

Fig. 8. *M. calcarea* var. *bicalyptrata*—British Columbia. Coll. W. R. Taylor. 1921.

Fig. 9. *M. calcarea*—Aplanospore, Casey, Illinois, April 22, 1911.

Fig. 10. *M. calcarea*—Zygospores drawn to scale after Wittrock, 1878.

Figs. 11, 13. *M. calcarea*—Zygospores, Carp Lake, Michigan, August 9, 1915.

Figs. 12, 14. *M. calcarea*—Aplanospores, West Point, Mississippi, April 16, 1925.

Fig. 15. *M. nummuloides*—Douglas Lake region, Michigan, July 28, 1924 (G. E. Nichols).

Fig. 16. *M. nummuloides*—Aplanospores, Burgaw, North Carolina. Coll. D. B. Anderson, March 30, 1926.

PLATE II.

Fig. 17. *Mougeotia gelatinosa*—After Wittrock. Bot. Not. 1889, p. 163.

Fig. 18. *M. maltæ*—After H. Skuja, 1926.

Fig. 19. *M. victoriensis*—After G. S. West, 1909.

Fig. 20. *M. depressa*—After Kutzing, 1855, Vol. 5, Pl. 7.

Fig. 21. *M. cyanea*—Douglas Lake region, Michigan, July 28, 1924. G. E. Nichols. The gelatinous pectic layer of the lower zygospore has disappeared.

Fig. 22. *M. cyanea*—Douglas Lake region, Michigan, showing zygospore and aplanospore.

Fig. 23. *M. megaspora*—After Wittrock, 1872, and Coll. O. Borge, Ave, Sweden, July, 1886.

Fig. 24. *M. gotlandica*—After Cleve, 1868.

Figs. 25–27. *M. scalaris*—Three zygospores, a parthenospore and a vegetative cell. Collected in the Douglas Lake region, Michigan, by A. B. Ackley.

PLATE III.

Fig. 28. *M. sphaerocarpa*—Zygospore and vegetative cell from material collected at Columbus, Ohio.

Figs. 29, 30. *M. sphaerocarpa*—Aplanospores showing variations, from Columbus, Ohio.

Figs. 31, 32. *M. sphaerocarpa*—Zygospores showing the part of the cell contents left outside the spore contracted about the spore wall.

Fig. 33. *M. sphaerocarpa*—Zygospores occurring in rows, in this instance with two parthenospores, the gametangial walls greatly thickened. This figure is very suggestive of West's figure of *Debarya africana*. See Ohio Jour. Sci. 25:196, Pl. I, Fig. 1.

Figs. 34, 35. *M. sphaerocarpa* var. *varians*—Aplanospore and zygospores from material collected by Walter R. Shaw, Manila, Philippine Islands.

Fig. 36. *M. crassa*—Redrawn to scale after Wolle, 1887.

Fig. 37. *M. ovalis*—Drawn from Wittr. & Nordst. Alg. Exsicc., No. 742.

Fig. 38. *M. macrospora*—Redrawn to scale after Wolle, 1887.

Figs. 39–41. *M. robusta*—Drawn from material collected at Winchester, Mass., July 15, 1908. Fig. 40 shows a spore formed by the union of three gametes of which I have encountered several.

PLATE IV.

Fig. 42. *M. angolensis*—After G. S. West, 1897.

Fig. 43. *M. genuflexa*—Drawn from material collected at Charleston, Illinois, a single pair of filaments showing lateral and scalariform conjugation and genuflexing. Some intervening vegetative cells have been omitted in making the drawing.

Fig. 44. *M. genuflexa*—Zygospore formed by lateral conjugation, showing that the conjugating tube primordia do not necessarily arise in contact with each other.

Fig. 45. *M. genuflexa* var. *gracilis*—Collected at Lerna, Illinois.

Figs. 46–50. *M. laetevirens*—Material collected at Cold Spring Harbor, Long Island, N. Y., August 2, 1924, shows three zygospores and two aplanospores.

Figs. 51, 52. *M. laetevirens* var. *varians*—After Wittrock, Bot. Notiser, 1886, p. 135.

Fig. 53. *M. pulchella*—Material from Douglas Lake region, Michigan. Collected by A. B. Ackley.

Fig. 54. *M. subcrassa*—After G. S. West, 1909.

PLATE V.

Figs. 55–57. *M. notabilis*—Material from Charleston, Illinois.

Figs. 58–59. *M. notabilis*—Material collected by L. H. Tiffany at Spirit Lake, Iowa, July 2, 1923. Showing variations in aplanospores and zygospores.

Figs. 60–61. *M. irregularis*—After West, 1897.

Figs. 62–64. *M. capucina*—Material collected by Wolle, "Mill pond," New Jersey.

Fig. 65. *M. capucina*—Vegetative cells; upper, the usual type; lower, from occasional filaments showing constricted chromatophore.

Fig. 66. *M. capucina*—Material from South Carolina collected by Ravenel.

Figs. 67, 68—*M. capucina*—Material from Wittr & Nordst. Alg. Exsicc. No. 539. Showing division of one, and of both gametes before conjugation.

Fig. 69. *M. capucina*—Aplanospore from Gainesville, Florida, March 3, 1925. Collected by W. M. Barrows.

Figs. 70, 71. *M. quadrangulata*—Aplanospore and zygospore from Gainesville, Florida, March 3, 1925. Collected by W. M. Barrows.

Fig. 72. *M. quadrangulata*—Zygospore showing retuse angles, occasional in a collection from Burgaw, North Carolina, by D. B. Anderson.

Figs. 73–75. *M. paludosa*—Vegetative cells and zygospores. After G. S. West, 1899.

Figs. 76, 77. *M. mayori*—Vegetative cell and aplanospore. After G. S. West, 1914.

PLATE VI.

Figs. 78–80. *M. boodlei*—Aplanospores, zygospore and a vegetative cell. All from the Campus Pond, Charleston, Illinois.

Figs. 81–83. *M. tenerrima*—Vegetative cell and aplanospores. After G. S. West, 1914.

Fig. 84. *M. elegantula*—Aplanospore from Charleston, Illinois, May 31, 1912.

Fig. 85. *M. elegantula*—After Wittrock, 1872.

Figs. 86, 87. *M. elegantula*—Vegetative cell, immature and mature zygospore; Twin Lakes, Michigan, June 2, 1915.

Figs. 88–93. *M. americana*—Vegetative cell, aplanospores and the highly variable zygospores. Oneida Lake, New York, July 20, 1916.

Fig. 94. *M. corniculata*—Vegetative cells and zygospore. After Hansgirg in Kirchner, 1878.

Figs. 95, 96. *M. gracillima*—Aplanospore and zygospores; Oneida Lake, New York, July 20, 1916.

PLATE VII

Figs. 97–98. *M. viridis*—Zygospores and aplanospores; Saugetuck, Michigan, June 1, 1915.

Figs. 99–101. *M. punctata*—Zygospores and vegetative cells; after Wittrock, 1867.

Fig. 102. *M. uberosperma*—Zygospores. After W. & G. S. West, 1898.

Fig. 103. *M. uberosperma*—Aplanospore and vegetative cells. Material collected by Miss E. Stephens, Kentani, Cape Colony.

Fig. 104. *M. virescens*—Zygospore. After Hassall, 1845.

Fig. 105. *M. tumidula*—Zygospore, aplanospore and vegetative cell. Zygospore from Embarras River, Wheeler, Illinois, September 1, 1911; aplanospore from Ocheyedan, Iowa, July 24, 1913, (L. H. Tiffany).

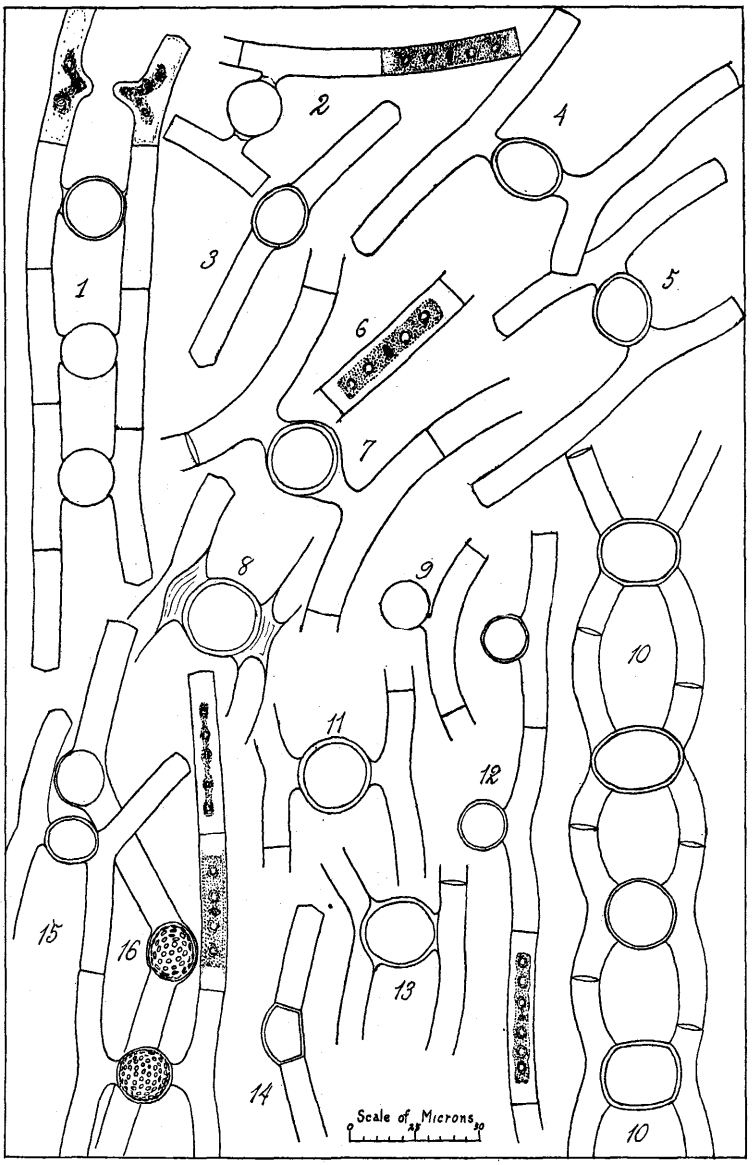
Figs. 106–108. *M. ventricosa*—Vegetative cell and aplanospores. After Wittrock, 1878.

Fig. 109. *M. prona*—Aplanospores showing variations. Long Island, New York, July, 1924.

Figs. 110–111. *M. prona*—Vegetative cell and early stage of aplanospore showing division of chromatophore and subsequent gliding of each half into the swollen portion of the cell.

Fig. 112. *M. tropica*—Vegetative cells and aplanospores. After G. S. West, 1916.

Figs. 113, 114. *M. producta*—Zygospore and aplanospores. After G. S. West, 1907.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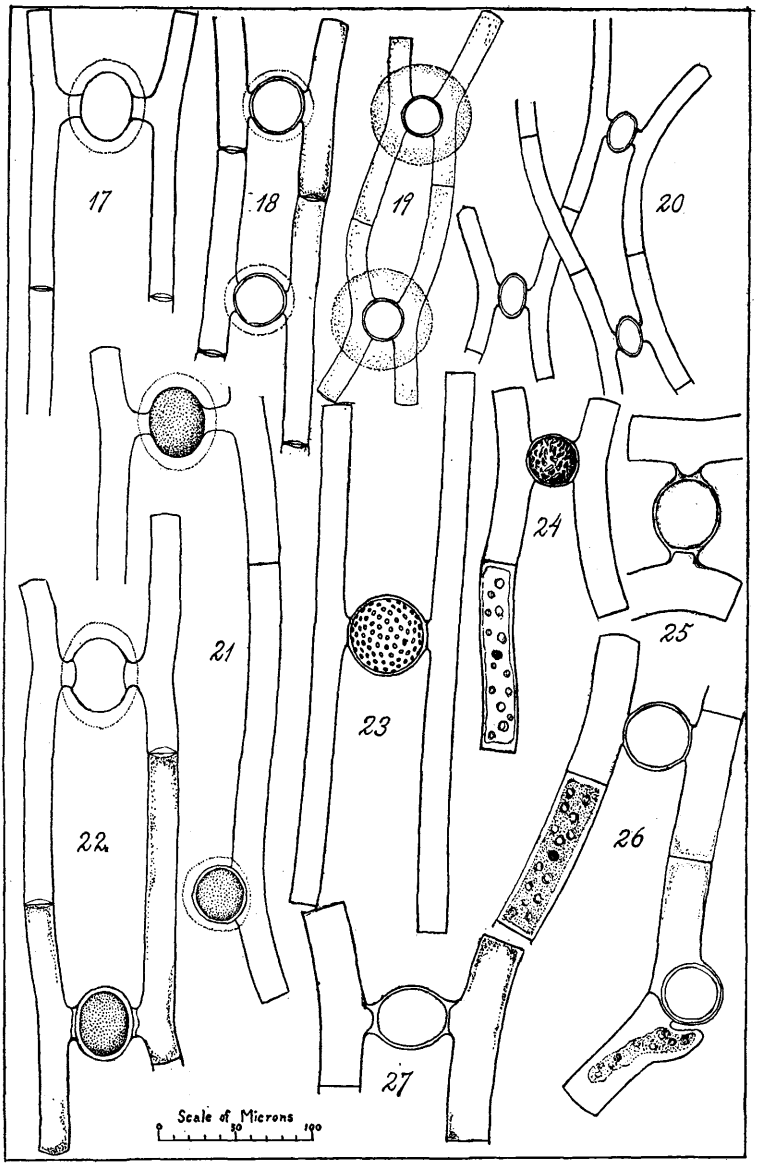
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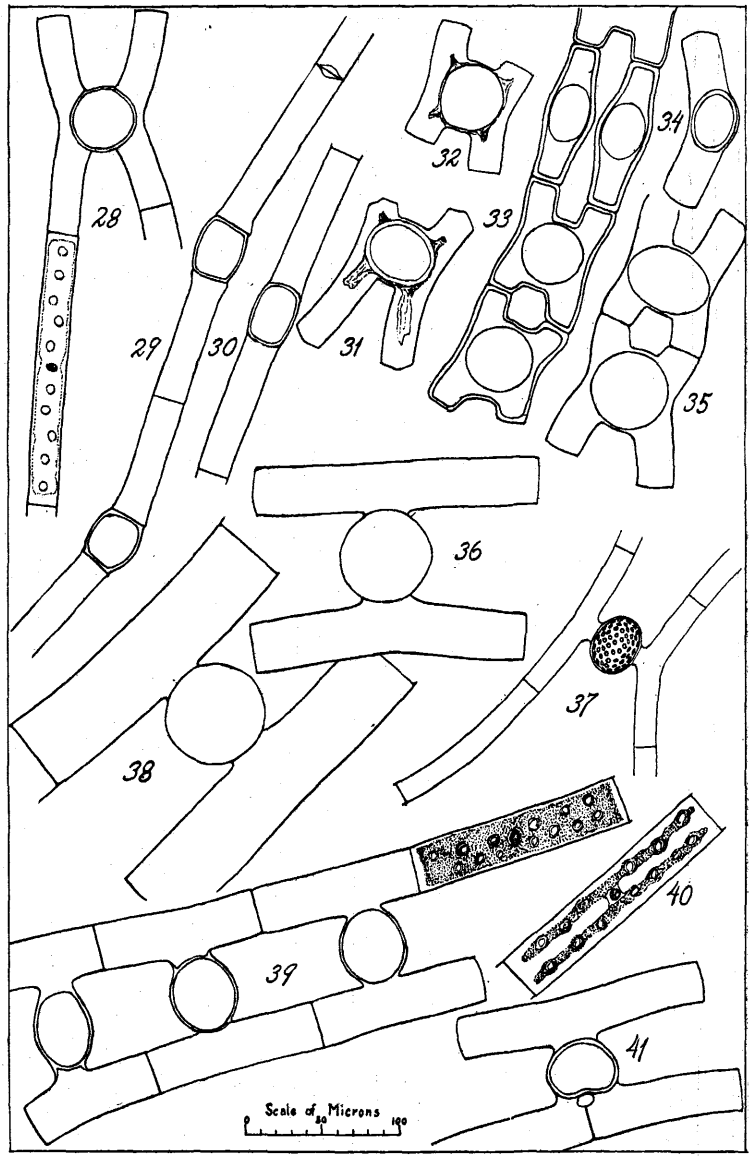
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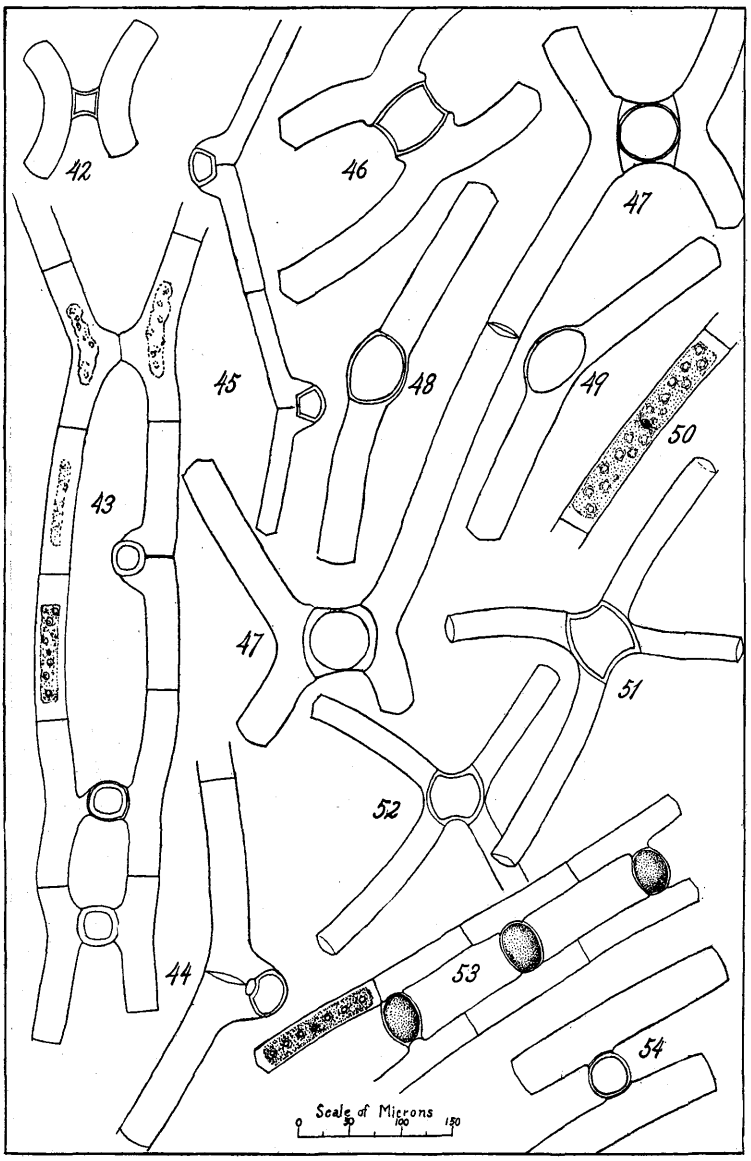
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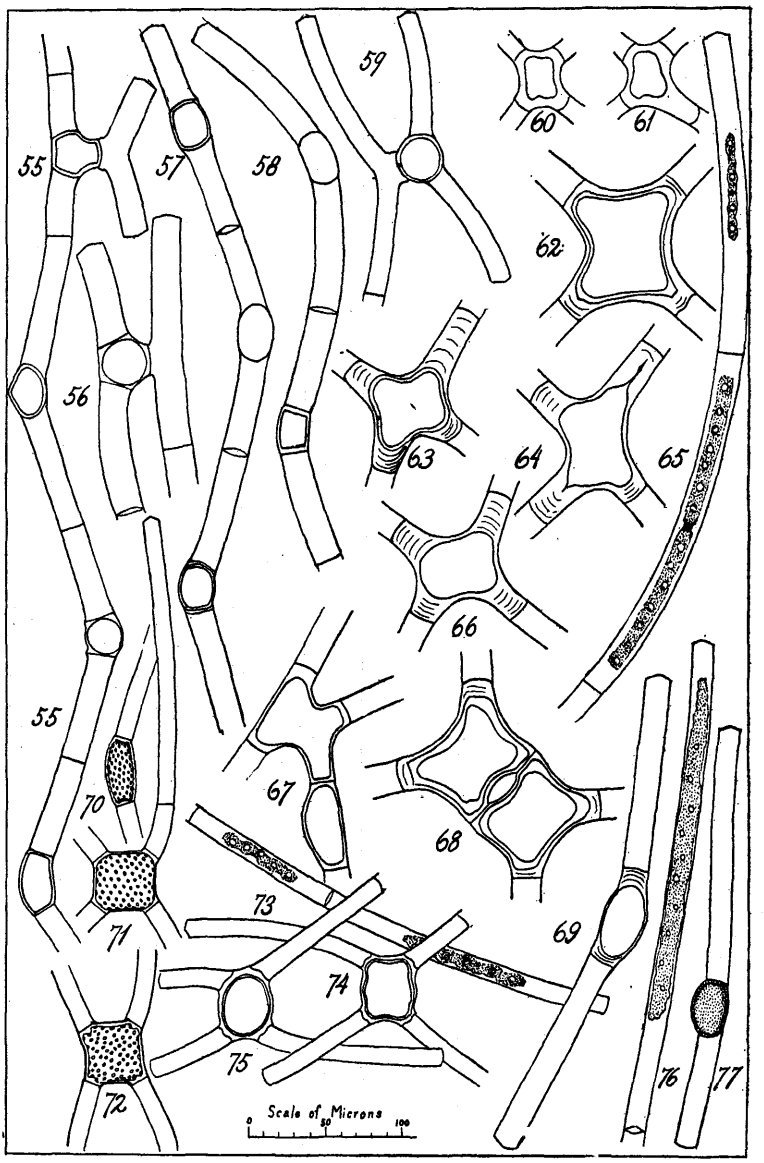
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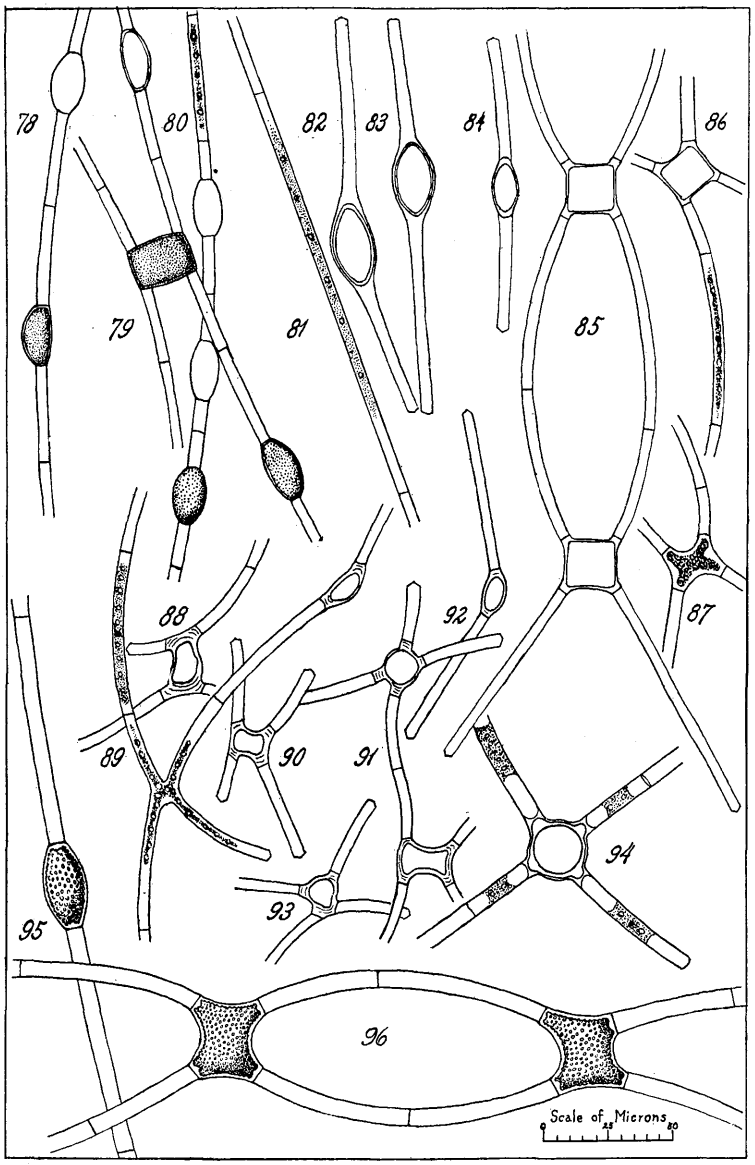
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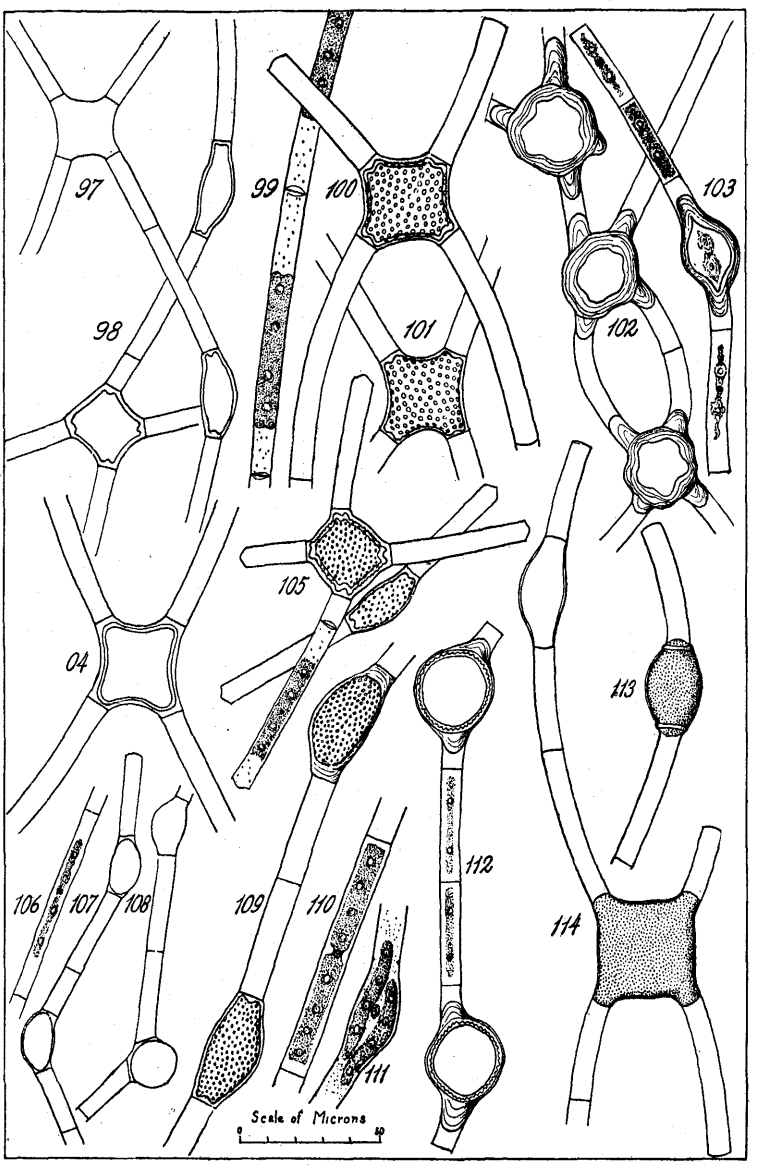
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